A COMPREHENSIVE STUDY ON

'ABDOMINO-PELVIC HOLLOW VISCUS INJURIES'

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CERTIFICATE

This is to certify that this dissertation titled “A COMPREHENSIVE STUDY ON ABDOMINO-PELVIC HOLLOW VISCUS INJURIES ” has been prepared by Dr.S.BALAJI, under my supervision in the Department of General Surgery ,Chengalpattu Medical College, Chengalpattu during the academic period 2007-2010 and is being submitted to the Tamil Nadu DR.M.G.R. Medical University, Chennai in partial fulfillment of the University regulation for the award of the Degree of Master of Surgery(M.S General Surgery) and his dissertation is a bonafide work.

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DECLARATION

I, Dr. S.BALAJI, solemnly declare that the dissertation “A COMPREHENSIVE STUDY OF HOLLOW VISCOUS INURIES” is a bonafide work done by me in the Department of General Surgery, Chengalpattu Medical College, Chengalpattu, under the able guidance of Prof.G.RAJA BILLY GRAHAM; Professor and HOD, Department of General Surgery , Chengalpattu Medical College, Chengalpattu.

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CONTENTS

INTRODUCTION

TRAUMA has been regarded as the number one killer in the world .As the world today moves into an era of 'Living life in the fast lane', there is an increased level of recklessness , carelessness and vice thereby making 'TRAUMA' the leading cause for mortality universally .In civilian life, trauma has always been a serious affliction to the increasingly mobile society. Abdominal injuries are mostly due to blunt trauma. Penetrating injuries are also seen with increasing frequency in hospital emergency departments, particularly in urban areas.

Solid viscera are more commonly affected in trauma and have attracted greater clinical attention and analytical interventional studies. But, abdominal hollow viscus injuries are no less common, and is equally life threatening with the possibility of exsanguinating bleeding compounded by perforation peritonitis.

In India there is an appreciable fall in ulcerative and infective perforations due to increasing availability of newer medical facilities. There is still one type of hollow visceral affliction which seems to be increasing, the one related to TRAUMA (both accidental and non accidental).

Despite remarkable developments and newer technologies like USG, CT scan and MRI ; good common sense, clear clinical history taking, skilful clinical examination acumen, simple radiographs, bedside investigations and a clear protocol can help in a reasonably accurate diagnosis in a remarkably high number of patients with hollow visceral injuries/perforations.

The pattern of injuries is protean and virtually any intra abdominal viscera can be involved ranging in spectrum from a serosal laceration, minor tear to complete transection of the bowel and associated organ rupture.

In developing into a good surgeon, the ability to tackle trauma cases, particularly those related to abdominal hollow visceral perforations/injuries is an important yardstick for effectiveness and good surgical skill.

OBJECTIVES OF STUDY

1. Describe the patterns of traumatic hollow viscus injuries.
2. Identify the organ(s) prone in specific forms of injury.
3. Attempt to link the morbidity and mortality to the delay in diagnosis and surgery.
4. Detail on the deceptive presentations in blunt injury abdomen.
5. Produce a protocol for the management of hollow viscus injury following penetrating and blunt injuries to the abdomen.

REVIEW OF LITERATURE

Hollow viscus perforations are one of the most dangerous events encountered in general surgical practice, irrespective of their presentation.

The problems of diagnosis, patient management and other decisions are compounded further when it occurs in association with trauma; the reason being the magnitude of injury that may amplify or may distract our attention regarding the hollow visceral perforations/injuries.

So, frequently there is delay or misdiagnosis during management which leads to the efflux of intraluminal contents into the abdominal events which rapidly become life threatening.

Although infective, ulcerative and malignant pathologies may have predilections towards certain sites, traumatic perforations/injuries (both accidental and non accidental) may involve any organ and at any site. Yet with all the uncertainties of unsuspecting Traumatic injuries, traumatic hollow viscus perforations/injuries may, in fact occur in certain well documented common sites as regards to the trauma.

In general, trauma may be:

1. Accidental
2. Non- accidental

It may also be:

1. Penetrating
2. Blunt

Diagnostic approaches to penetrating and blunt trauma differ substantially, while little preoperative evaluation is needed in penetrating injuries with a breach of peritoneum, a comparatively cautious and careful approach may be feasible in blunt abdominal trauma.

- **PENETRATING INJURIES:**

GUN SHOT AND SHOT GUN WOUNDS:

Following a gunshot wound, there is a high incidence, 80% of intra abdominal injury. Anterior truncal gunshot wounds between fourth intercostal space and pubic symphysis whose trajectory as determined by entry and exit wounds or indeterminate, should be operated upon. Gunshot wounds from the back or flank are more difficult to evaluate because of the greater thickness between skin and abdominal organs. In this situation, it is always safer to explore the abdomen for hollow viscous perforation/injuries, than to speculate when the depth of penetration is uncertain.

- **STAB AND OTHER PENETRATING INJURIES** :

Stab wounds that penetrate the peritoneal cavity are less likely to injure

intra abdominal organs in contrast to gunshot injuries, i.e., 20 – 30 % of times following a stab injury.

While injuries that do not penetrate the peritoneal cavity do not require any further evaluation, those in which local exploration raises suspicion should be taken up for surgery. Stab wounds may look fairly innocuous during preliminary clinical examination and presentation. But the intra abdominal injury may be catastrophic due to the possibility of a hollow viscous perforation/injury. In case of stab injuries, entry and exit wounds need thorough exploration under LA.

Stab wounds and other penetrating injuries to the lower chest present a diagnostic opportunity. After the administration of adequate local anaesthesia, and extension of the wound as necessary, a finger is placed in the thoracic cavity to palpate the diaphragm; confirmation of diaphragmatic penetration is an indication for thoracotomy.

- **BLUNT INJURY:**

Blunt injury usually results from:

- ✓ Crush injury
- ✓ Blast injury
- ✓ Seat belt syndrome(acceleration-deceleration injuries)

The type of blunt injury may range from a fall from height, trivial accidents, high intensity impacts, to deliberate trauma directed towards the abdomen and pelvis. Usually sudden application of pressure to abdomen is more likely to rupture a

solid organ than a hollow viscous, particularly when associated with less resilient or fixed tissue of older people. The intensity of the impact may not always indicate the amount of internal hollow viscous injury. Instead the impact may leave certain imprints or tell tale signs of severity and location of the internal damage, this include rib fracture, tyre marks (in RTA), skin discoloration, meteorism , distension, guarding/rigidity, rebound tenderness, protrusion of intra abdominal contents and others.

- **IATROGENIC INJURIES/PERFORATIONS: (0.2-5%)**

  Iatrogenic abdominal injury may be due to:

  - Endoscopy
  - ECM (External Cardiac Massage)
  - Peritoneal dialysis
  - Paracentesis

The mind boggling number of endoscopical procedures that are being carried out into the intra abdominal organs has explored the possibility of iatrogenic perforations. Basically any hollow viscus that is being endoscopied may get perforated or injured, as a result. Laparoscopy is also frequently implicated as a cause of iatrogenic injuries.

Hence malignancies, ulcerative and other inflammatory pathologies should make the surgeon doubly cautious while performing these procedures.

Perforations can also be caused inadvertently during surgical procedures like laparotomy due to a casual and inexperienced approach during the surgery, especially

during the closure when the bowel may be included by a blind application of a suture.

DEFINITION OF PERFORATION:

Perforation is defined as a breech or rupture in the continuity of the hollow viscera leading to efflux of contents into the peritoneal cavity.

The abdomen encompasses a large area of the body from diaphragm superiorly to the intragluteal fold inferiorly, including the entire circumference. For evaluation the abdomen has been divided into:

1. Intra thoracic abdomen
2. True abdomen
3. Pelvic abdomen
4. Retro peritoneal abdomen

TRAUMATIC PERFORATION INJURIES OF THE ABDOMEN

- **STOMACH:(10%)**

Injuries/traumatic perforations are very rare in blunt trauma, but common in penetrating injuries as the stomach is intrathoracic and protected by the rib cage. Even when injured, it is difficult to diagnose. These perforations may present with ambiguous clinical features. Blunt trauma causing gastric rupture is rare, but may occur after abrupt deceleration which occurs in seat belt injuries and other blunt

abdominal trauma, particularly in the presence of distended abdomen. Gunshot injuries in which the perforation may involve both the anterior and posterior walls are usually even in number, while odd number indicates a mixed perforation.

- **DUODENUM:(<5%)**

Perforation/injuries related to blunt trauma usually involves the second part of duodenum, particularly the posterior wall. It is associated with abrupt deceleration crushing the retroperitoneal duodenum against the spine or causing a blow out of the air filled closed duodenal loops. Pain referred to shoulder, chest and back, may be associated with perforation of the duodenum. Indices of suspicion increase particularly when there is:

1. History of deceleration
2. Blood in nasogastric suction
3. Blood/bile staining of midline retroperitoneum
4. Wounds penetrating upper mid abdomen

Adjunctive diagnostic tests for hyperamylassemia as a result of extravasations of amylase into the abdominal cavity and increase in the serum amylase is another diagnostic criteria.

Special consideration is due for duodenal injuries as combined pancreatic-duodenal injuries are not uncommon, particularly in penetrating trauma. Duodenal

traumatic perforations are particularly dangerous because of the risk of duodenal suture line dehiscence, and the development of a duodenal fistula.

- **GALL BLADDER AND DUCTAL SYSTEM**: (<1%)

These injuries though not common, may be associated with concomitant liver/duodenal/pancreatic injuries. Perforations/rupture of GB due to blunt trauma are very unusual, penetrating abdominal trauma frequently causes GB injuries. During surgical emergency laprotomy this can easily become a surgeon's nightmare as minor but serious injuries of the biliary tract may be missed and present later with a calamitous event .

- **SMALL INTESTINES**: (60-65%)

Even though injuries to small bowel are more common than injuries to either duodenum or colon, it usually escapes injury during trauma. The reason being they are relatively mobile and slide away and escape injury. But penetrating injuries may injure small bowel at any location in line with the site of entry (particularly so with gun-shot injuries).

Blunt trauma causing perforation/injuries in small bowel are commoner and occur in relation to certain well-documented and explained sites. Three mechanisms have been proposed to explain small bowel injury:

1. Midline compression of bowel against the lumbar vertebrae

2. Tearing of the bowel at fixation points such as ileo caecal valve and the ligament of Treitz
3. Bursting of the bowel due to increased intra luminal pressure.

Small bowel injury is commonly associated with concomitant mesenteric tears/lacerations, which complicates management, while increasing fatalities.

- **COLON: (20%)**

Colonic injuries commonly involve the immobile portions of the descending and ascending colon (splenic flexure and hepatic flexure), particularly when associated with trauma to inter- abdominal wall and the flanks. And also the hepatic and splenic flexure may commonly be associated with liver and spleen injuries.

Colonic perforations are one of the most catastrophic events due to release of highly infective faecal material directly into the peritoneal cavity. Posterior perforations of the ascending and descending colon may not always communicate with the peritoneal cavity and instead may form a retroperitoneal abscess which may present in the posterior abdominal wall.

Acts of violence constitute an important source of injury to colon and these are generally penetrating injury caused by guns or sharp weapons and on rare occasions, blunt abdominal trauma and road traffic accidents.

- **RECTUM:**

In all penetrating injuries of perineum, gluteal regions and lower abdomen, rectal injuries should be suspected. Injuries of rectum are the most serious of all intestinal

perforations because of its extra peritoneal location. Poorly vascularised fatty tissues surround the rectum without fixed anatomical boundaries so that wounds of the rectum permit rapid spread of infection in the virtually unlimited retroperitoneal space.

In addition rectal perforations may occur in mentally retarded, old individuals and persons with perverted sexual indulgence as may be associated with foreign body insertions. Falls resulting in impalements on sharp objects may produce rectal injuries. Bull Gore injuries constitute another important cause .

- **BLADDER:(5%)**

In adult, the bladder is an extra peritoneal organ relatively well protected from external trauma by the bony pelvis, in contrast, the bladder is an intraperitoneal organ in a child and is susceptible to external injury .It is involved 60-85% in blunt injury and 15-40% in penetrating injuries.

Bladder rupture may be either intraperitoneal or extra peritoneal. Intraperitoneal bladder rupture occurs as a result of a sudden blow to the lower abdomen/pelvis with a full bladder. The dome represents the most vulnerable part of the bladder. Extra peritoneal bladder rupture occurs with equal frequency and is closely associated with pelvic fracture. Indeed 80 – 100% of extra peritoneal bladder ruptures are associated with pelvic fractures, conversely only 5 – 10% of pelvic fractures are associated with bladder ruptures.

Penetrating trauma to the lower abdomen from gunshot or stab wounds may injure the bladder. Bladder injury may occur due to bony fragments from a pelvic fracture.

Blunt trauma to the bladder may occur from RTA, blows to the abdomen, falls, and crush injuries of pelvis. A full bladder is particularly susceptible to intraperitoneal rupture from blunt trauma.

PERFORATION PERITONITIS

The chronological events that follow a hollow viscus perforation are the stages of peritonitis.

PRIMARY STAGE:

Peritoneal irritation

SECONDARY STAGE:

Peritoneal reaction

TERTIARY STAGE:

Bacterial peritonitis

PRIMARY STAGE:

Immediately after the perforation there is dramatic increase in symptoms, due to intense irritation of the peritoneum by escaping intra abdominal contents. It results in peripheral vasoconstriction, sweating and inhibition of respiration. There is intense pain, and worsening of the symptoms.

SECONDARY STAGE:

This stage usually occurs in 2 – 6 hours depending on the size and site of perforation and the magnitude of the peritoneal soiling. The pain may get reduced,

beguiling a false hope towards conservative line of management. The associated tachypnoea, tachycardia and profound vasoconstriction may point towards the serious nature of the disaster. There may be obliteration of liver dullness on percussion due to pneumoperitoneum.

TERTIARY STAGE:

This stage usually occur upto 12 hours or more after perforation, pain is less severe, vomiting more frequent; abdominal distension develops as a result of paralytic ileus. Dehydration becomes severe and profound shock and septicaemia ensues, which when untreated becomes rapidly fatal and irreversible.

PHYSICAL EXAMINATION:

Physical assessment should proceed in an orderly fashion. The patient should be evaluated for signs of blunt trauma and for penetrating wounds. Small abrasions or area of ecchymoses may represent warning signs of significant intra abdominal injury. All penetrating wounds need to be marked with radio opaque clips and a subsequent radiograph taken to delineate the trajectory of the bullet or path of the knife.

Absence of bowel sounds may be helpful to assess significant peritoneal irritation from bowel contents or blood, but may take significant time to develop, making this a late finding following injury.

The patient's respiratory pattern should be evaluated, which may give clue to significant abdominal trauma. Halted, laboured breathing may result from diaphragmatic irritation or accompany upper abdominal injury. Palpation may reveal localized

tenderness, spasm or rigidity of the abdominal wall. The passage of a Foley's catheter should be delayed until radiographic evaluation and urethrography. Percussion may reveal obliteration of liver dullness. Rectal examination is imperative. A nasogastric tube is passed, if blood is aspirated, it indicates need for laparotomy in penetrating trauma.

INTEPRETATION OF PHYSICAL FINDINGS:

Injuries to abdomen may involve solid organs, vascular organs and hollow organs. Interpretation of the physical findings associated with these injuries is often a function of the amount of time that each of these organs require to create peritoneal irritation. The spectrum of injury may range from intra abdominal bleeding with no physical findings except hypovolaemic shock to a patient with immediate peritoneal irritation from inflammation following hollow viscous injury. Small intestinal injury may not produce findings for 24 hours, which requires frequent evaluation as an essential part of management protocol, which rests short of definitive diagnosis.

INVESTIGATIONS

Physical examination alone is unreliable in making a decision towards explorative laparotomy in case of injury to the abdomen and pelvis. However, most authorities agree that the presence of abdominal rigidity and gross abdominal distension are an indication for prompt surgical intervention. Drugs, alcohol or injuries to head/spinal cord complicate physical examination.

INVESTIGATIONS:

1. X- ray chest PA view
2. Flat/decubitus and upright X- ray of the abdomen
3. Contrast radiography
4. Blood investigations:

    - Blood TC DC; urea, sugar, creatinine
    - Serum amylase, electrolytes
    - Blood grouping/typing
    - Blood Hb/PCV

5. Urine analysis
6. Blood gas analysis
7. USG
8. CT scan
9. Laparoscopy
10. Diagnostic Peritoneal Lavage
11. Four quadrant tapping

- **X -RAY CHEST PA VIEW**:

It is useful to evaluate both the abdomen and chest. Air under diaphragm is much easier to diagnose in an erect film than in an upright abdominal film.

- **FLAT/DECUBITUS AND UPRIGHT X RAY ABDOMEN**:

Both the views are important to diagnose intraperitoneal air, when the patients are unable to tolerate the erect position due to pain, or when unconscious, the upright view will not only be difficult to perform but unsafe for the patient. In this situation, a left lateral decubitus view will provide similar information with less risk of pain or injury.

Air in the peritoneal cavity is many a time due to perforation in the gastrointestinal tract. A properly performed examination can detect as little as 10 ml of air. It is seen as a curvilinear collection of air between the line of the diaphragm and the opacity of the liver. Free air under diaphragm on the left side is difficult to diagnose due to overlapping stomach gas shadows and splenic flexure of colon. Multiple fluid levels may also be seen.

- **CONTRAST RADIOGRAPHY**:

In a proportion of cases with doubtful X- rays and unreliable clinical findings, water soluble contrast radiographic pictures of the upper GI tract may help diagnose. Contrast material is always used in conjunction with computed tomography.

- **RADIOGRAPHY IN BLADDER/URETHRAL INJURIES**:

X- ray of the pelvis/abdomen may reveal ground glass appearance in case of bladder rupture, and may be associate with disruption or fracture of the pelvis. In doubtful cases bladder rupture is established by static cystogram. A Foley's catheter

is passed into the bladder if there is no urethral injury (or after obtaining retrograde urethrogram if urethral injury is suspected), and a scout film is taken. Anteroposterior, both oblique and post drain films are taken. The use of CT cystography has been advocated as a time saving procedure but controversial and expensive.

Bladder contusions represent a non- full thickness injury of the mucosa of muscular layer and no extravasation is identified on cystogram . In intraperitoneal rupture of bladder, cystography shows extravasation of contrast material outlining the bowel loops and filing the paracolic gutters; whereas in extraperitoneal rupture of bladder the contrast extravasates into the pelvis around the base of the bladder.

- **BLOOD INVESTIGATIONS**:

Hemogram:

A normal Hb percentage and haematocrit value (PCV) shortly after injury may be misleading because sudden acute shock following hollow viscous trauma may not be adequately reflected by haemograms due to a short span at presentation.

Blood Glucose and Creatinine:

Usually remains normal in acute hollow visceral trauma. However in elderly patients with diabetes and compromised renal parameters, it may show some abnormalities.

Serum Electrolytes:

Serum electrolytes rarely become abnormal. However potassium level is

extremely important if laparotomy is contemplated. Unrecognised hyper or hypokalemia may lead to disastrous consequences.

Serum Amylase:

When elevated (300-1000 IU) it is a reliable indicator of intra- abdominal injury, in particular, those associated with duodeno pancreatic trauma. Abnormal values may also be seen in upper small bowel trauma. Leakage of amylase containing fluid is rapidly absorbed into the blood from the peritoneal cavity. Serumn isoenzyme of amylase has been found to be more specific for duodeno pancreatic trauma, than total serum amylase estimation.

Urine Examination:

Urine deposits for sediments may indicate injury to genitourinary tract. Dipstick urine analysis is a cost- effective way of determining hematuria and has been found to be very effective.

Blood gas analysis:

Blood gas determination is important in all hollow viscous perforations of abdominopelvic trauma, when associated with multisystem involvements (CVS, Respiratory system, etc)

- **USG: (FAST-Focussed Abdominal Sonography in Trauma Patients)**

Sonography has been evaluated in blunt trauma of abdomen, the results have been mixed. While solid abdominal visceral trauma (liver/spleen/kidney/pancreas) is almost accurately diagnosed with USG, hollow visceral trauma has not been easy to

pick up.

- **CT SCAN:**

Hollow organs are harder to evaluate unless contrast is used. This is recommended both orally and intravenously. Some authors have used rectal contrast to identify colon injuries. Intravenous contras will permit assessment of the genito urinary system and possibly obviate the need for an intravenous pyelogram. Associated duodeno- pancreatic injuries, liver, spleen and flexural injuries of colon are also well defined with a CT.

- **LAPAROSCOPY:**

There is a surge of interest in laparoscopy in abdominal trauma patients. Early results of recent studies are beginning to emerge indicating a beneficial effect on a selected group of patients from this procedure. This is indicated in patients thought to have penetrating injuries but with no other indications for operation. On the other hand, numerous injuries have been missed on lap and have been detected at laparotomy. These include urethral injuries, pancreatic injuries, liver, colon and diaphragmatic injuries. The utility of laparoscopy under LA is increasing.

However, frequently the major limitation is performing a comprehensive examination of entire abdomen/pelvis especially recesses and retroperitoneum and the complication of CO_2 embolism.

Indications:

1. In presence of associated closed head injuries (including altered consciousness and spinal injuries)
2. Equivocal abdominal findings
3. Negative needle paracentesis

Contraindications:

1. Gunshot wounds to lower chest/abdomen
2. Stab wounds to the back
3. Previous abdominal procedures/surgeries
4. Presence of dilated bowel loops
5. Late pregnancy
6. Haemodynamically unstable patient

- **DIAGNOSTIC PERITONEAL LAVAGE (DPL)**

  A method for diagnosing intraperitoneal injuries by infusing a litre of normal saline into the peritoneal sac and then assess the returning contents microscopically and biochemically.

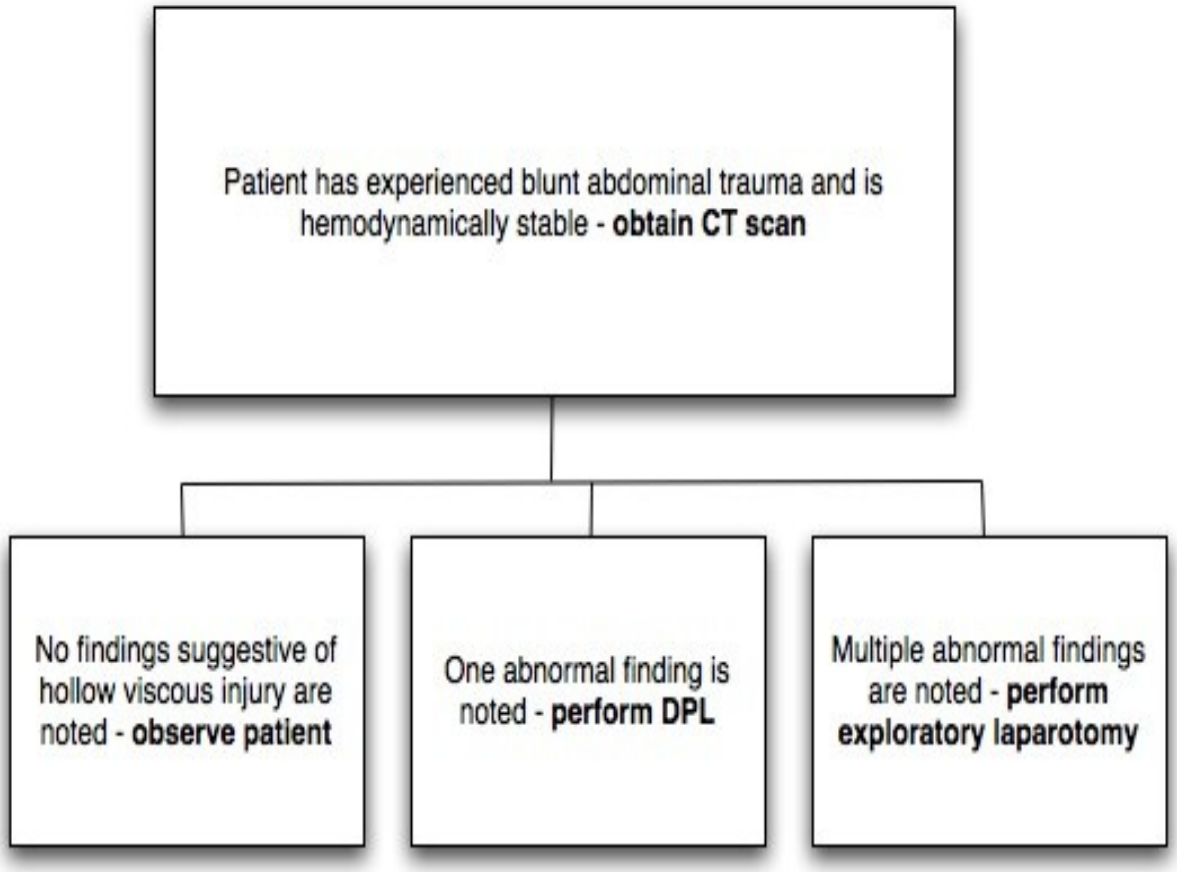
Criteria for a positive DPL

1. Aspiration of >10ml of blood.
2. Aspiration of intestinal contents
3. RBC>1,00,000/mm^3 ; WBC >500/mm^3

4. Lavage fluid amylase >20IU/l
5. Lavage Fluid Alkaline Phosphatase>3IU/l
6. Lavage fluid containing bile ,undigested food particles,bacteria

Outcomes of DPL

Laparotomy required	RBC > 100,000/cubic mm
	WBC >500/cubic mm
Equivocal	RBC 50000 – 100,000/ cubic mm
	WBC 100 – 500 cubic mm
Non-operative management	RBC < 50000/ cubic mm
	WBC < 100/ cubic mm



MANAGEMENT OF ABDOMINO PELVIC

HOLLOW VISCOUS INJURIES

EXPLORATORY LAPAROTOMY IN CLOSED INJURIES (blunt injuries):

When there is a definite evidence of intraperitoneal injury, or when doubt persists, laparotomy should be done. There are 2 situations:

1. A profoundly ill patient, often with multiple injuries, in whom all clinical and other investigations have failed to exclude the abdomen as a source of shock. In such a situation, a multi modality team approach is important.

2. An apparently well patient with doubtful signs. There is a case for considered delay, more so if the provisional diagnosis is rupture of a hollow viscous rather than blood loss. Repeated examination of the patient should not be spread out over more than 2 – 3 hours for, by this time if intra abdominal injury has occurred, secondary pathological consequences will have begun to develop making management difficult. Hence, if doubt persists after such an interval, diagnostic laparotomy should be performed.

MANAGEMENT IN PENETRATING INJURIES:

In large wounds, evisceration of abdominal organs or omentum may clinch the issue as may an exit wound, so placed that the peritoneal cavity should have been traversed.

If these features are absent, the surgeon must rely on some symptoms and signs of closed injury. Injury to retroperitoneum and its structures such as duodenum, pancreas or caecum is then hard to exclude.

In these circumstances the rule is "*it is safer to look and see; than to wait and watch"*.

As an alternative method, 20 ml of contrast medium may be forcibly injected along the track and X- rays taken in two planes. This method is reasonably effective,

but not “fail safe” in demonstrating breech of peritoneal cavity. This may be supplemented by wound excision to demonstrate peritoneal breech.

INDICATIONS FOR LAPAROTOMY IN PENETRATING WOUNDS

Unequivocal indications are:

1. Hypotension without other cause
2. Other evidence of continuing bleed
3. Evisceration, unless there is a stab wound with omental protrusion and no evidence of hypovolaemia or peritoneal irritation
4. Air under diaphragm
5. Unequivocal signs of peritoneal irritation

Diagnostic Peritoneal Lavage is not recommended in penetrating injuries because a tear of the peritoneum without injury to viscera can produce a positive result. In the absence of the above indications, it is justifiable to observe, in that laparotomy with its attendant morbidity can be avoided in about a third of patients. With penetrating injuries, repeated observations over 6 – 12 hours can help avoid a few laparotomies.

Rarely, if a patient is seen after 24 – 36 hours of injury, the fact that he or she is alive implies one or other of the two things:

a) There has not been significant visceral damage.

b) The damage has been successfully localised, and that conservative treatment with parental fluids and electrolytes, NGT and suction, and antibiotics has a role, while the patient is reviewed constantly.

PREOPERATIVE MANAGEMENT OF ABDOMINAL INJURY:

1. Establishment of an adequate channel for volume replacement and administration of sufficient replacement electrolytes to stabilize the circulation.
   Blood, packed RBCs up to 6 – 10 units should be made available.
   Volume replacement should be a measure of urgency, dripping in fluid over a period of an hour or two is no way to prepare the patient, up to 1 – 2 litres may have to be transfused within 10 minutes.

   Auto transfusion of blood is done by sucking into a sterile suction bottle containing 150 ml of 3.8% sodium citrate dextrose solution, so that RBCs can be washed and reperfused. This is particularly needed if compatible blood is not available.

2. Passage of a nasogastric tube to decompress stomach is an important step not only for preoperative decompression to help anaesthetist but may help diagnose any intraluminal bleeding.

3. Bladder catheterisation for emptying the bladder and for measuring the timed output.
4. Administration of preoperative antibiotics.

Some teams with wide experience in abdominal trauma put the patient into modified Trendelenberg's position. This gives the opportunity of putting a second assistant between the patient's legs and allows access to the anus for on table lavage should this prove to be part of management.

TECHIQUES OF EXPLORATION:

In open injury, the site of entry and the inferred direction of track are the chief determinants of the position of abdomen incision. In majority of cases a long midline incision is adequate, which may be extended transversely either subcostally or inferiorly. However, the exception to this rule is when the entry and exit wounds are placed obliquely in one quadrant of abdomen only.

In this days of minimal invasive surgery, it should be emphasised that the vertical incision should be large (20- 25 cm initially) and extended without hesitation to visualise paracolic gutters, to thoroughly inspect all abdomen and pelvic organs.

In case of associated chest injuries, the thoraco-laparotomy may be preferred.

PROCEDURE AT LAPAROTOMY:

Any life threatening bleeding occurring due to associated solid visceral injuries, should be dealt with early to prevent further deterioration. A formal laparotomy must be carried out by examining and eviscerating all small bowel so that the pelvis can be examined. Infracolic compartment is examines along with colon. The diaphragm and the solid viscera are then examined, then the lesser sac is opened and the pancreas examined, colon and duodenum are mobilised and examined.

Only an uncompromising focussed examination would reveal the small perforation or serosal disruption, particularly those that are veiled by omentum.

DECISION MAKING:

The formal laparotomy permits a total assessment of extent of intraperitoneal damage and allows the operator to access the priorities and the pattern of treatment. This assessment should help decide on the surgical procedure to be embarked upon. An early decision may help anaesthetic and resuscitative needs and hasten the treatment.

WHAT TO DO AFTER A LAPAROTOMY:

Any intraperitoneal collection should be sucked out first. If exsanguinating hemorrhage is suspected, the origin should be identified and appropriate hemostatic procedure like clamping of the vessels or packing of the organ should

be done without delay. If need to be, the retroperitoneum should be opened when injuries to ascending, descending colon, second and third part of duodenum is suspected.

❖ **STOMACH:**

Gastric injuries can be occasionally missed if the wound is located in the mesentery of the lesser curvature or high in the posterior fundus. The stomach should be clamped at the pylorus and inflated with air or injected with methylene-blue coloured saline solution if there is any doubt. Patients with the injuries that damage the nerve of Latarjet or both vagus nerves should have a drainage procedure. If the distal antrum or pylorus is severely damaged, it can be reconstructed with a Billoth I or II procedure. A running two- layer suture line is preferred for the stomach because of its rich blood supply and because post operative haemorrhage has occurred when the single layer technique has been used in the stomach. The post operative complications include intra abdominal abscess particularly in lesser sc and fistulae, following the surgery or as a direct consequences of the injury. Treatment is immediate reoperation and repair.

❖ **DUODENUM:**

Duodenal injuries usually present with associated pancreatic injuries. Hence prompt examination of pancreas too becomes necessary in case of duodenal injuries. A generous Kocher's manoeuvre is performed to expose the pancreatic head and first two parts of the duodenum, lesser sac opened widely

through the gastro colic omentum to examine the body and tail of pancreas and the third portion of the duodenum. Visualisation of the 4th portion of the duodenum is facilitated by division of the ligament of Treitz. Limited duodenal contusions are best left alone, when discovered at laprotomy. Placement of gastrostomy and feeding jejunostomy tube should be considered for extensive contusion when delayed resolution of the hematoma is anticipated.

Most perforations of the duodenum should be treated by primary repair using single layer 3-0 monofilament suture material, taking care that the largest possible residual lumen is left.

Extensive injuries of the first part of the duodenum are usually dealt by debridement and anastamosis due to presence of good mobility and rich blood supply of distal gastric and pylorus. In contrast complex injury to the 2nd part of duodenum is complicated due to its fixity to pancreas, its blood supply and the ducts which may necessitate complex anastomotic procedure like Roux-en-Y duodeno- jejunostomy. Injuries to the 3rd and 4th portions of the duodenum with tissue loss are further compounded by a short mesentery which limits mobilisation and increases the risk of ischemia. End to end anastamosis can be complicated by duodenal fistulas.

Post operative bleeding is the most important complication. Duodenal fistulae occur in 5 – 10% of patients following anastamosis. It is usually managed non- operatively with nasogastric suction, nutritional support and aggressive

stoma care. Uncomplicated fistulae close by 6 weeks, those which do not, are treated by surgery.

❖ **SMALL INTESTINE:**

Simple closure in two layers is the treatment of choice in perforations following penetrating and blunt injuries after trimming the edges. Resection may have to be carried out if the following criteria are present in the bowel injuries:

1. Injuries that cannot be closed without significantly narrowing the bowel lumen
2. Large irregular wounds
3. Short segments containing multiple perforations
4. Areas that are infracted or crushed and are unviable
5. Injury to the leaves of mesentery
6. Large hematoma at the mesenteric border
7. Large intra- mural hematoma
8. Avulsion of mesentery
9. Large transverse tear in the mesentery
10. Long linear lacerations of the bowel

Standard anastamotic techniques can be used for bowel repair without compromising blood supply. Simple serosal tears and circumscribed areas of contusion can be treated by Lembert sutures applied to the serosal coat.

The complication may be:

1. Intra abdominal abscess or Anastamotic leakage→ Drainage
2. EnteroCutaneous fistula: Low output →Conservative treatment
   High output→ Surgical treatment
3. Intestinal obstruction: Naso gastric suction & parental nutrition

❖ COLON AND INTRAPERITONEAL RUPTURE OF RECTUM:

If patient arrives soon (within 4- 6 hours) after the trauma, peritoneal soiling is limited. Simple closure of the perforation may suffice but when patient presents late and the peritoneal soiling is extensive, exteriorization of the damaged bowel segment (when possible) or a diverting colostomy when exteriorization is not possible or technically difficult is the treatment of choice.

Choices for the Surgeon in the management of colonic injuries:

1. Primary closure
2. Resection and primary anastomosis
3. Primary closure with proximal colostomy
4. Resection with colostomy
5. Exteriorization (loop colostomy)

As there is always a temptation for primary repair, the following indications should be kept in mind before embarking on such a procedure:

1. Wound involving less than one third of circumference
2. Mesenteric aspect uninvolved
3. Good blood supply
4. Absence of extensive peritonitis
5. Injuries less than 8 hours old
6. No extra peritoneal rectal injury
7. Will not prolong management of associated severe or multiple system injuries

❖ **BLADDER:**

Decisions are based on the location and the extent of the injury. Intraperitoneal rupture of bladder from blunt or penetrating trauma should be explored and repaired via transabdominal incision so as to allow exploration of abdomen for associated injuries. Any extraperitoneal tear should be closed from within the bladder using a single running layer of chromic catgut or polyglycolic suture. The ureteral orifice should be inspected for injuries, if necessary, passage of ureteral catheters into each ureters helps identification of ureteral or ureteral orifice injuries. A large caliber suprapubic catheter is placed near the dome of the bladder and brought out through a separate stab incision in the bladder and skin.

Most cases of extraperitoneal bladder rupture due to blunt injuries do not require operative intervention and heal within 7- 10 days by urethral drainage only. However, if laparotomy is performed or associated intraperitoneal injuries, intravesical repair of the bladder can be done. The perivesical hematoma should be left undisturbed.

Iatrogenic bladder injuries occur mostly during endoscopy or laparoscopy. For small iatrogenic perforations caused by endoscopic procedures, drainage of the bladder by a large calibre Foley's catheter would suffice, provided the patient is hemodynamically stable and shows no sign of respiratory embarrassment due to urinary ascites. Larger perforations/ruptures may require a formal laparotomy.

- **URETHRAL INJURIES**:

It is usually more common in men, associated with either pelvic fractures or so called straddle injury. They present with fractures, perineal hematoma, perineal injury, blood at urethral meatus and high displacement of prostate.

Diagnosis is by retrograde urethrogram, commonly the posterior urethra is involved, and treatment may need laparotomy and rail roading. It may be complicated by post operative strictures.

- **GYNAECOLOGICAL ENCOUNTERS**:

Perforations of the uterus consequent to illegal abortions form a distinct

subset affecting susceptible population. The presentation may be delayed following indigenous abortions. The perforations most often affect the dome of the uterus and present with hypogastric pain and bleeding PV, which, depending on the severity of the injury and resulting haemorrhage, may produce hypovolaemic shock. Prolapse of small bowel per vaginum and /or associated lacerations/serosal tears may be encountered and necessitates the attendance of the surgeon in conjunction with a gynaecologist, in the repair of small bowel injuries and closure of the uterine perforation.

MATERIAL AND METHODS

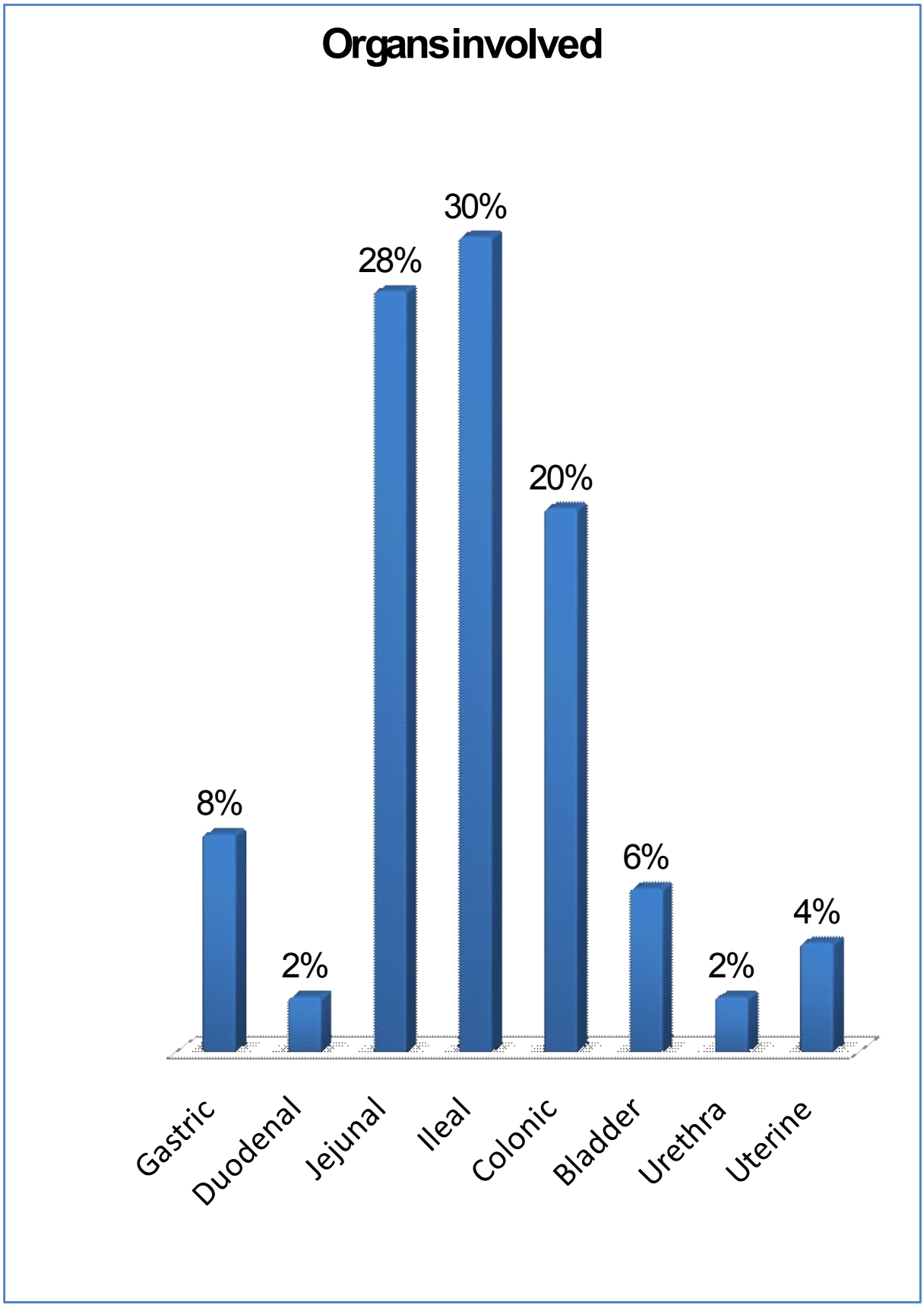
The cases have been selected from patients seeking surgical attention at Chengalpattu Medical College Hospital between July 2007 and October 2009. All suspected cases were followed up from the beginning of admission till their eventful discharge/death. All relevant information and details were gathered from the case sheets and hospital records and from interviews.

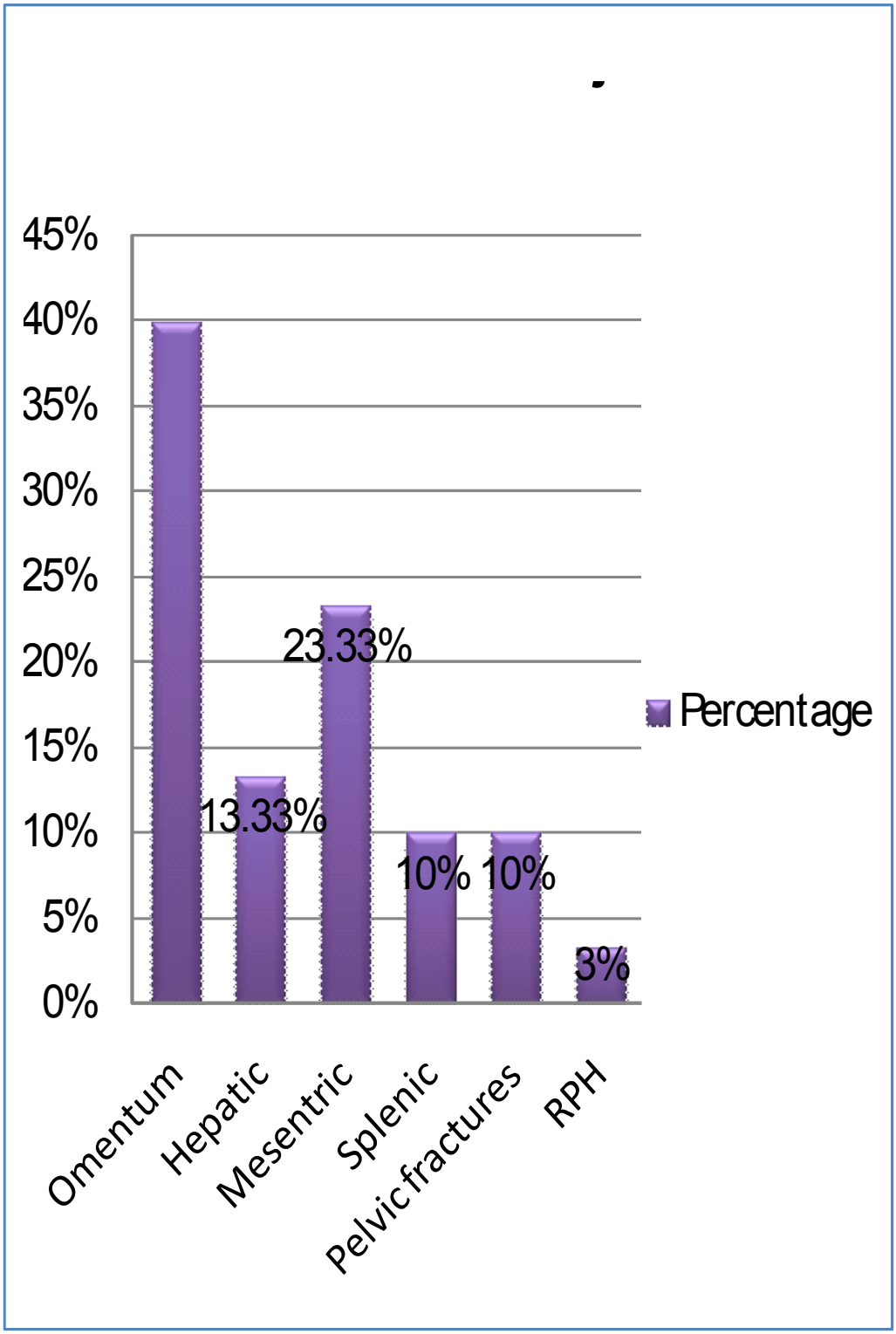
To streamline the collection of information, all details were entered in customised proformas. The entries were tabulated under different categories and further indexed to facilitate comparison between comparable groups/subgroups.

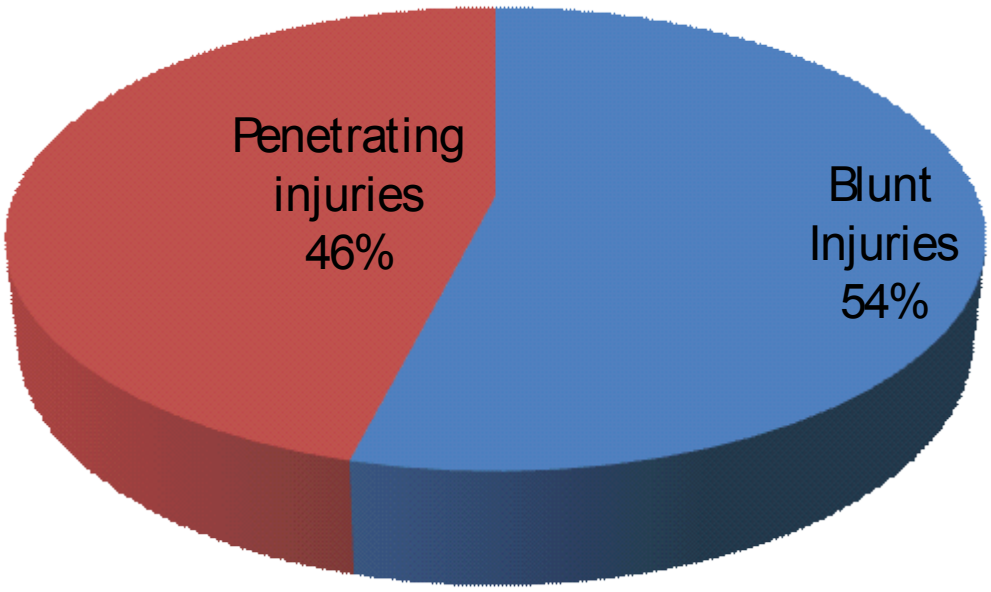
All cases were run through simple baseline blood and urine analysis. Skiagrams of abdomen and chest were essential part of the investigative workout. Clinical information at the time of admission especially hemodynamic parameters and salient abdominal findings were duly recorded. Cases were assigned into different graded categories depending on the time lag from the time of symptoms, of presentation to the time of surgery. Intra- operative findings were compared with the provisional diagnoses. The site and the size of the perforations, the amount of peritoneal soiling, associated intra- abdominal pathologies, the nature of operation performed and other relevant general factors have been tabulated. Postoperative events were recorded and all complications that arose were noted and but since no autopsy was ever performed; only the probable cause leading to or immediately responsible for death could be conjectured.

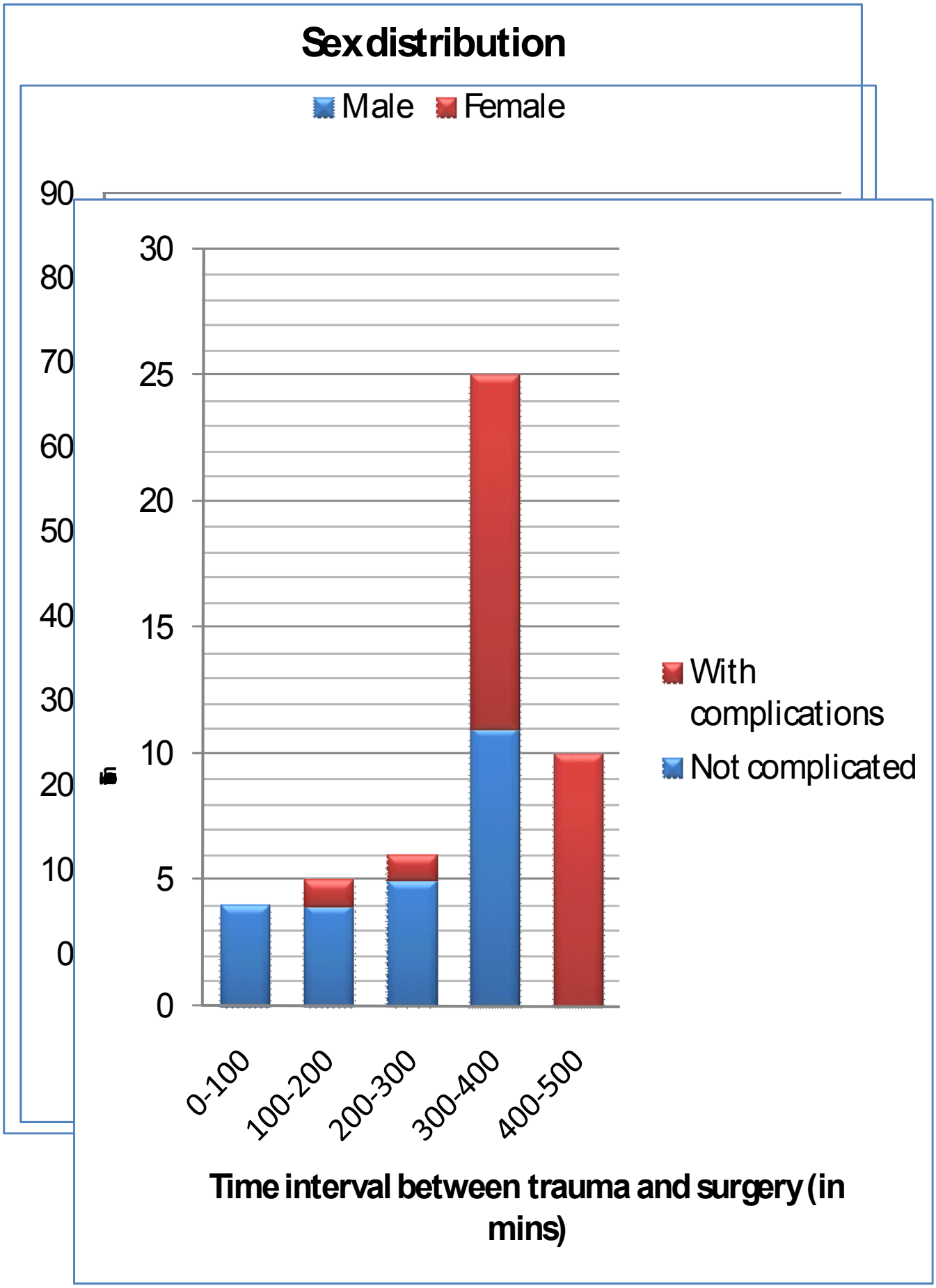
In cases of traumatic hollow viscus injuries, relevant history was elicited to

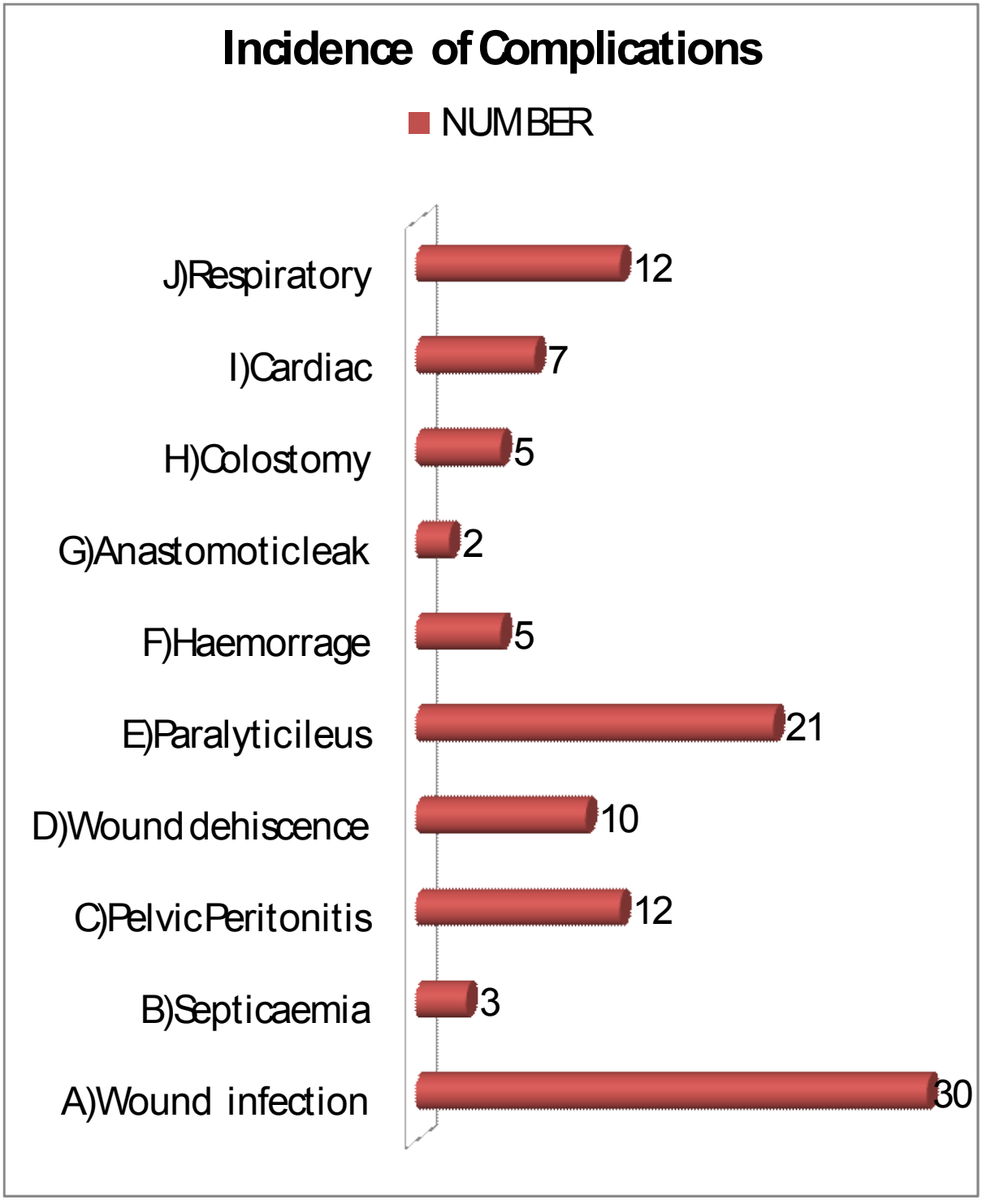
determine the nature of violence/traumatic force, its extent, the weapon used (if any), time of the incident, time of presentation, time of surgery, any time expended in initial resuscitation or revival, the condition of the patient at presentation and any other major injuries were also carefully noted.

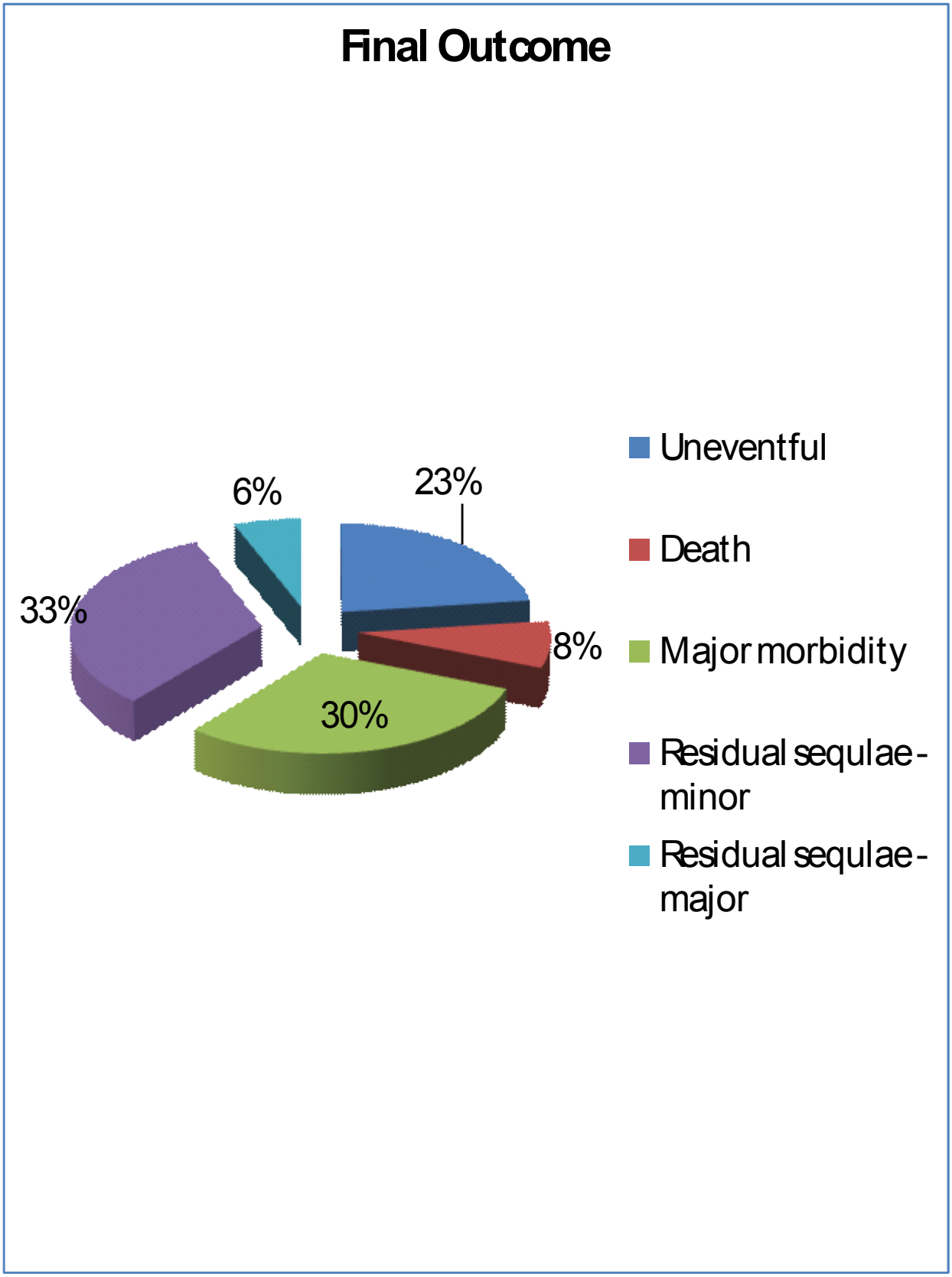

Organsinvolved
8%
2%
28%
30%
20%
6%
2%
4%
Gastric
Duodenal
Jejunal
Ileal
Colonic
Bladder
Urethra
Uterine


45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
23.33%
13.33%
10%
10%
3%
Percentage
Omentum
Hepatic
Mesentric
Splenic
Pelvic fractures
RPH


Penetrating injuries 46%
Blunt Injuries 54%


Sex distribution
Male
Female
90
80
70
60
50
40
30
20
10
0
30
25
20
15
10
5
0
With complications
Not complicated
0-100
100-200
200-300
300-400
400-500
Time interval between trauma and surgery (in mins)


Incidence of Complications
NUMBER
J)Respiratory
12
I)Cardiac
7
H)Colostomy
5
G)Anastomoticleak
2
F)Haemorrage
5
E)Paralyticileus
21
D)Wound dehiscence
10
C)PelvicPeritonitis
12
B)Septicaemia
3
A)Wound infection
30



ANALYSIS

Traumatic cause accounts for about 25.95% of all case of hollow viscous

trauma/perforations.

Penetrating injuries were present in 54% of cases. Most blunt injuries were due to road traffic accidents. One case of accidental occupational impalement injury was also recorded.

The male: female ratio was 7:1

The age specific incidence: the most frequent occurrence was in the 20- 40 age group accounting for 58.0% of cases followed by 26% in the 40- 60 age group. It occurred in 8.0% in the 0- 20 age group.

The most common site to be affected was ileum and jejunum, followed by colonic and gastric injuries/perforations; duodenal and bladder injuries in one such case; uterine injuries occurred in two cases.

SITE	NO.OF CASES	PERCENTAGE
GASTRIC	4	8.0%
DUODENAL	1	2.0%
JEJUNAL	14	28%

ILEAL	15	30%
COLONIC	10	20%
BLADDER	3	6.0%
URETHRA	1	2.0%
UTERINE	2	4.0%

Associated other organs trauma: the commonest was omental contusions and tears in 12 cases (40.0%) followed by mesenteric(23.3%),hepatic(13.33%) and splenic(10.0%) ;pelvic fractures occurred in 3 cases (10.0%) and renal injuries in 1 case (3.33%)

ORGAN INJURY	NO. OF CASES	%AGE
OMENTUM	12	40%
HEPATIC	4	13.33%
MESENTERIC	7	23.33%
SPLENIC	3	10.0%
PELVIC FRACTURES	3	10.0%
RPH	1	3.33%

OUTCOME SPECTRUM:

- 23% had an uneventful postoperative period and recovered completely.
- 33% had minor postoperative complications and recovered completely.
- 30% had major morbidity
- 3% had major morbidity with residual sequale.
- 6% died in the postoperative period.

Analysis of factors that would have a bearing on the final outcome mortality would reveal that:

- The average age in those cases that died was 44.33 years Vs. 34.2 years in those

who had survived.

- The average blood pressure in presentation was 80/60 in the former Vs. 96/70 in the latter.

The overall mortality rate was only 6%,(penetrating injuries usually account for most mortality following HVI, but in our series it was the blunt injuries causing HVI that were more) ,while those with major morbidity accounted for 30%. The immediate cause responsible for death was:

- Associated liver injury with severe on table haemorrhage in 1 case
- Cardiac complications with septicaemia in 1 case
- Septicaemia in 1 case

The average hospitalization days was 18 days (range 1-49 days)

DISCUSSION

Traumatic hollow viscous perforations are accountable for a smaller proportion of cases of all abdominal traumas. Nevertheless they present with some distinct features that alters their management significantly vis-à-vis non- traumatic perforations.

1. The lacerations/perforations, on an average tend to be bigger, than those due to an underlying pathology. Compared to the circumscribed perforations in non- traumatic hollow viscus perforations; the perforations in traumatic hollow viscus perforation tends to assume a wide varying shapes often with ragged edges depending on the state of the bowel, the assailants weapon and the dynamics of assault.
2. The evaluation and progression of the deterioration in the general condition of the patient tends to be rapid and swift in traumatic perforations dictated by the nature, site and the extent of bowel/bladder injury and other associated injuries, whereas in non- traumatic perforations, the chronicity enables the local defence mechanisms to limit the effects that would otherwise manifest and indeed an omentum can very well seal the perforation and abort the clinical progression.
3. Traumatic hollow viscus perforations can present with haemo-dynamic shock related to the amount of intra abdominal and external haemorrhage

sometimes severe enough to require emergency measures to revive the patient. The breech of medium calibre or big vessels can cause a torrential haemorrhage that can cause rapid hypovolaemic shock and death. Non-penetrating (blunt) traumas can cause liver, splenic or mesenteric tears that can present similarly and with the absence of external bleeding, the elicitation of signs of intra- abdominal bleeding and haemo- dynamic compromise is imperative to enable the institution of necessary therapeutic measures. Non traumatic hollow viscus perforations, on the other hand, can present with massive intra- abdominal bleeding when the perforation breaches major vessels (eg., gastroduodenal in duodenal perforation) but are more usually due to peritonitis and hence tend to occur terminally.

4. Penetrating hollow viscus injuries can be associated with multiple perforations and with other organ injuries that adds to the complications and the mortality rate. The path the weapon takes primarily dictates the order of the organ injury and the viability and the mobility of certain tissues may be, though away from the site of injury, involve them and hence the need for the thorough inspection of the other organ systems and bowel segments at laparotomy. In blunt injuries to abdomen, the broader surface area of application of force risks a wider underlying area to tissue injury.
5. The medico- legal importance of traumatic hollow viscous perforations/injuries need not be over emphasised. The attending surgeon

has to be meticulous for the travails of testimony and cross examinations in the court of law and may expose any deficiencies in the management and treatment of the case which may bring into critical introspection the competence and the ethics of the surgeon.

The factors that need to be discussed and that are pertinent to in influencing the final outcome in cases of traumatic hollow viscous injuries are:

1. Severity of initial injury
2. Nature and pattern of injury
3. General condition at presentation
4. Time delay between injury and surgery
5. Involvement of critical organs
6. Postoperative care and management of complications

The initial injury may be severe enough to cause death within a few minutes before the patient can be presented at the hospital. The cause, fast enough to cause near instantaneous death could be due to:

a. Breech of major vessels and resulting exsanguinations
b. Rupture/laceration of vascular organs viz, liver/spleen with haemorrhage

The amount of internal bleeding can manifest as hypovolaemic shock or as subtle ellicitable signs of a precarious vascular state indicating a just compromised vascular compartment. Organ injuries vary in their propensity towards life threatening

haemorrhage. Deep lacerations and vascular pedicle injuries are inevitably associated with moderate to severe haemorrhage. *Hollow viscus trauma in themselves are not immediately life- threatening but can be if they are associated with vital organs, and large bony fractures.*

Obvious thoracic injuries take precedence over abdominal injuries when they are obviously responsible for the collapsed state of the patient and are necessarily treated as emergencies. The management of Flail chest, acute respiratory distress arising from open lung injury, pneumo-thorax, cardiac tamponade and cardiac injuries requires a team of dedicated personnel with personal experience in the treatment of these injuries and sophisticated back up.

Associated fractures of pelvis and the femur sequester blood massive enough to cause shock. These are usually encountered in blunt injury abdomen caused by RTAs and volume replacement and stabilisation becomes imperative to resuscitate the patient.

Penetrating injuries constituted 46% of the cases . The injuries tend to be more circumscribed and deeper. The presentation depends on the site of injury and hence the underlying organ involved. When vital structures underlie the path of the weapon, the management tend to be more serious and severe.

Blunt injury trauma to the abdomen constituted 56% of the cases. Most were due to RTAs and the pattern of the injuries was variable. The liver and spleen were commonly affected and lacerations of stomach and duodenum or the mesentery were other associated injuries. They were more often associated with a poor clinical condition

at presentation. Intra abdominal bleeding could more readily be established by needle paracentesis and with the associated hemodynamic instability constitutes a clear indication for laparotomy.

The complication rate was significantly higher in penetrating injuries, due to bowel injuries and complications consequent to its repair.

Once an intra- abdominal injury has been suspected, the prime factor deciding the outcome is the *time period between the time of injury or* The procrastination from indecision significantly raises the complication rate. Each complication has been assigned a letter and average number of complications in patients taken up for surgery is categorised in time frames. It would be apparent from the accompanying bar chart that the complication rate continues in an upward trend. As more time elapses, showing a sudden surge when the delay approaches 400 minutes. There are other factors however that may also contributes to the complication rate, mainly the nature of the injury and the organ involved. The mortality rate was also the highest in these cases. It would become clear then that this (need to operate at the earliest in suspected cases) becomes a major preventive step from complications and mortality.

The commonest complication was wound infection. Since this may also reflect the aseptic conditions practised, it has not been included in the calculation of the average complication rate. Respiratory complications mainly basal atelectasis, pneumonitis and acute bronchitis complicated cases mainly those with perforations, lacerations and intra peritoneal spill of contents which also caused peritonitis and paralytic ileus increasing

the morbidity and hospitalisation days.

Multiple organ involvement contributes directly to the complication rate and mortality and reflects the violence/force of the impact. Apart from omental and mesenteric tears that commonly occurred with both penetrating and non penetrating injuries, hepatic and splenic injuries, common in blunt traumas were severe enough to cause shock at presentation. Pelvic fractures associated with bladder/urethral injuries were of very serious nature both by the amount of haemorrhage and the urethral damage, requiring initial resuscitation measures and expert urological intervention.

The male preponderance reflects the greater mobility of males exposing them to the risk of RTA and the clustering of cases in the second to fourth decade reflects the greater mobility, social interaction and a temperament prone to conflict and confrontations. The mortality and the complication rates were higher in the older age groups mainly because of pre-existing cardiovascular and respiratory labile state.

The factors responsible for or contributing towards mortality were increasing age, presence of multiple injuries, major organ injuries, delay in undertaking surgery and presence of other general (respiratory or cardiac) anaesthetic risk factors. The single most important factor directly responsible for the increased mortality is the delay in surgery. The delay may lie in

1. Arriving at a proper diagnosis
2. Critical condition of the patient requiring stabilisation before he/she can be taken up for surgery

3. Lack of advanced anaesthetic or cardiac support apparatus

The commonest condition that was found frequently associated with mortality was respiratory viz. basal atelectasis and pneumonitis, the next being generalised peritonitis secondary to florid peritoneal soiling associated sequestration of fluid in the third space followed by cardiac and haemorrhage complications.

CONCLUSIONS

From the study and analysis of the patterns of presentation and clinical outcome in cases of traumatic hollow viscus injuries, it can be concluded that:

1. In a referral hospital like Chengalpattu Medical College with trauma care, dealing with intra- abdominal emergencies consequent to trauma forms an important part of surgical management and training.
2. The clinical presentation may vary from a deceptively normal appearance to those in a collapsed and moribund state and the pattern of injury can be complicated by the association with other clinical organs like liver, spleen, kidney, pancreas, etc.
3. While dealing with intra-abdominal hollow viscus emergencies associated with multi-system involvement, the surgeons should prioritize the management of immediately life threatening injuries over those of low ominous significance.
4. Though penetrating abdominal injuries are more commonly associated with HVI than blunt injuries(as per the international studies-4:6),in our study ,it was found that blunt injuries were the leading cause for HVI (5.4:4.6).The probable explanation for this could be the increased incidence of gunshot injuries in the international studies as causes for penetrating injuries leading to HVI. Stab injuries , which was commoner in our study ,have only 20% chance of causing HVI , as compared to gunshot injuries which has 80-90% chance of causing HVI.
5. There is an increased incidence of complication and mortality when:
    a. There is an inordinate delay in presentation.

b. There has been inadequate pre-operative resuscitation measures
c. There are other unrelated risk factors for surgery.
d. There is precious loss of time in deciding on the need and nature of surgical intervention.
e. The surgical procedure undertaken is unduly prolonged and complicated.
f. The injury involves distal segments of the intestines with considerable peritoneal spillage of bowel content.
g. Since most of the cases were medico-legal, the surgeon is biased towards an active surgical intervention without equivocating, so as not to miss even a minor injury or a masquerading major injury.
h. The proper management of traumatic hollow viscous injuries requires the application of good clinical acumen, quick decisions, technique and adequate post- operative back- up facilities and care.